Ergotic / epistemic / semiotic functions

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Claude Cadoz [Cadoz, 1994] has introduced a typology of human-environment relation, identifying three functions. This typology allows characterizing univocally, i.e. in a non-redundant manner, the computer devices and interfaces that allow human to interact with environment through and by computers.

These three functions are: the epistemic function, the semiotic function, the ergotic function. Conversely to the terms epistemic and semiotic that are usual, the term ergotic has been specifically introduced, by Claude Cadoz [*in* Boissy, 1992] [Cadoz, 1994] [Cadoz 2000] to identify a function of man/environment relations that cannot be implemented by any association of the epistemic and semiotic functions.

Epistemic function

The epistemic function of man/environment relations is the function supported by the human perceptual apparatus: vision and audition apparatus, and proprio - tactilo - kinaesthetic apparatus (kinaesthetic and tactile receptors). One can speak of the epistemic function of vision, audition, and of the haptic sensory modality, as stated by in the book *Touching for knowing* [Hatwell et al., 2003].

Semiotic function

The semiotic function is the function conveyed by the human channels that are able to emit information toward the world. Humans are equipped only by two such emitting channels: the mechanical body producing gestures (body, arm, hand, face, etc…) and the vocal apparatus producing aero-acoustical motions. Some types of human gesture aim fundamentally at transmitting information to the environment (and not energy, though energy exchanges may be involved secondarily). That is the case of the gestures that accompany the speech, of the sign language of the deaf-mute, of the gestures of musical conductors, of the gesture that consist in pointing a target with the finger, of the action consisting in moving around an object (walking, etc), of the cutaneous touch without movements of muscles and joints, of pulling a infinitely light object.

Ergotic function

The ergotic function intervenes when physical energy is exchanged as a structural functionality of the man/environment relation, i.e. when this energetic exchange is strictly necessary in the performed task, which could not be achieved by other means. A specific ability of the gesture channel is to handle directly the matter: to mould it, to transport it, to break it, to cut, to rub, to hit, etc. The hand (or the whole physical body) is in such cases in contact with the matter, and exchanges physical energy with it. It applies forces, displacements, deformations to the object, and the object reacts on the human body, resisting to the energetic transfer, and retroacting a part of it [Luciani, 2004]. The fact that energy is exchanged is, in these cases, essential. Ergotic interaction aims not only at informing the external world and at being informed by it, but, more fundamentally, at transforming physically the world. That is made possible thanks to the fact that the gesture channel is intrinsically bi-lateral: it allows acting-on and perceiving in an inseparable way. Hence, during an ergotic interaction, simultaneously with the energetic exchange, the subject both knows (epistemic function) and inform (semiotic function).

The term Haptic is often used to state this function. Unfortunately, as stated by E. Pasquinelli [→ Haptics, in cognitive sciences], this term covers several meanings underlying

several different points of view. In addition, when it is used alone, haptics refers mainly to a part of the human sensori-motor apparatus with no consideration on the relation with the type of information exchanged with the environment. Conversely, the term ergotic, rooted on *ergos* (physical work, energy), represents clearly the principal property of such function. But above all, the current use of haptics, for example in VR, does not cover the idea that this energetic exchange is not only an intuitive help for the user, i.e. an improvement of the performance of the manipulation, but also plays a relevant and structural role in the results themselves. In Musical performance for example, the ergotic property of the interaction with a bow is not only a necessity for the playability of the instrument. More important, it is responsible of the subsequent dynamics and, intimately, of the nature of the sounds. We can say that sound embodies the performed ergotic gestures.

Ergotic and Epistemic-Semiotic functions and technology

The Cadoz' category is efficient to categorize in a non-redundant manner the devices and systems developed to allow the human to interact with the environment through electrified (and further computerized) non-opto mechanical devices. Hence:

- The epistemic and semiotic functions do not require necessarily force feedback devices, nor computer models that simulate the physical consistency between their action inputs and their sensory outputs. A typical example is the control of an electrified fire alarm by an electrified button.
- The ergotic function conversely requires necessarily the use of force feedback devices and of models that simulate the physical consistency between action inputs and sensory outputs. A typical example is the playing of a virtual violin with a force feedback device representing the bow. In this case, force feedback is necessary for the player to perform the gesture, and the sound produced (acoustical energy, dynamics, timbre) is intrinsically the expression of the physical, ergotic interaction.

References

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Related items

Haptics, in cognitive sciences
Instrumental interaction
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